# Status of TauPlusJets2012 Code

Catrin Bernius Louisiana Tech University

OU HEP meeting

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#### • 2012 Analysis code:

https://svnweb.cern.ch/trac/atlasusr/browser/bernius/TauPlusJets2012

- Instructions on how to set up code and how to run it can be found in the README file
  - Note: There are further README files in HplusChallenge/HplusChallenge/ README-PhysicsClass, locations are noted in main README file



- Before committing your changes to svn:
  - Make sure your local version is compiling and running!!
  - Also describe your changes in the ChangeLog file

#### Basic changes



#### Started off with Bill's version of the HplusCore code

- Removed object selection function FillObjectVector by breaking it up in
  - ElectronSelection
  - MuonSelection
  - TauSelection
  - JetSelection
  - TOPMETVector
- Changed cutflow back to how HplusCore cutflow was done
- Separate classes for Muon (MuonPtSmeared) and Electron scale factors (el\_E\_corrected) so they can be called whenever needed without having to re-write large parts of the code

#### Summary table of where to apply which object energy scaling and smearing

	Et scaling	Et scaling syst	Et smearing	Et smearing syst MC	
Electrons	data	MC	MC		
Muons	MC	MC	MC	MC	
Jets: JES/JER	MC and Data (JES)	MC or Data (JES)	No	MC (JER)	
Jets: JVF	MC	MC	N/A	N/A	
MET	data(from ele) and MC (mu and j)	MC	MC	MC	

# ElectronSelection (1)



- Electron Object selection function:
  - set larVetoEle variable for electron lar hole rejection in cut flow
  - electron quality cuts: el\_tightPP, el\_author, el\_0Q
  - option to set the electron energy rescaling & smearing
    - new function combining electron energy rescaling (data) and smearing (MC) float el\_E\_corrected(), returning corrected electron energy
       → avoid having the rescaling code twice (in electron loop and MET loop)
  - afterwards calculating the correct electron energy and direction for pix&sct and basically TRT standalone tracks
  - etiso correction (no changes made here)
  - eta & Et cut
  - electron muon overlap (electron-jet overlap done in JET LOOP)
    - Bill's version contains two of them → should be checked!!
  - then filling of the vectors

# ElectronSelection (2)



• Corrections/Scaling:

https://twiki.cern.ch/twiki/bin/view/Main/PhotonPlusMetSusy2012

• updated packages and descriptions (egammaAnalysisUtils-00-03-24)

Electron related				
Energy & direction	yes	yes	Code snippet on D3PDs  Reference	
Energy scale	yes	no	Use egammaAnalysisUtils-00-03-24 EnergyRescaler er; er.useDefaultCalibConstants("2012"); new_E = scale.applyEnergyCorrectionMeV (e_cl_eta, e_cl_phi, e_E, e_Et, SYST_FLAG, "ELECTRON"); //energies in MeV SYST_FLAG iS 0=NOMINAL, 1=ERR_DOWN, 2=ERR_UP (one sigma variations). Reference	
Energy resolution	no	yes	Use egammaAnalysisUtils-00-03-24 EnergyRescaler er; er.useDefaultCalibConstants(*2012*); smear.SetRandomSeed (EventNumber + 1001 * iele); double smearedEnergy = oldEnergy * er.getSmearingCorrectionMeV(cl_eta, oldEnergy, SYST_FLAG, CT_FLAG); iele is the index of the electron within its collection (before any selections). SYST_FLAG is 0 for nominal scale, 1 or 2 for 1-sigma variations. CT_FLAG should be false for all MC12 physics samples (produced with zero constant term for the LAr EM resolution). Reference	

# Electron selection should be up to date in code!!

# MuonSelection



https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/MCPAnalysisGuidelinesData2012

- Changes made compared to 2011
- Number of pixel hits+number of crossed dead pixel sensors > 0 (was 1 in 2011).
- Number of SCT hits+number of crossed dead SCT sensors > 4 (was 5 in 2011).
  - A successful TRT extension where expected (i.e. in the eta acceptance of the TRT). An unsuccessful extension corresponds to either no TRT hit associated, or a set of TRT hits associated as outliers. The technical recommendation is therefore:
  - Let  $n_{TRT}^{hits}$  denote the number of TRT hits on the muon track,  $n_{TRT}^{outliers}$  the number of TRT outliers on the muon track, and  $n := n_{TRT}^{hits} + n_{TRT}^{outliers}$
  - $\circ~$  Case 1: 0.1<|\eta| < 1.9. Require n > 5 and  $n_{TRT}^{outliers} < 0.9$  n.
  - Case 2:  $|\eta| \le 0.1$  or  $|\eta| \ge 1.9$ . If n > 5, then require  $n_{TRT}^{outliers} < 0.9$  n.

# This is now implemented in the code!! Muons Selection up-to-date!!

#### TauSelection

- Nothing to report yet, should be again like in HSG6 analysis.
- Needs more work/studies!

### JetSelection



- Outstanding issues/tasks
  - Reject event if there is a LooseBadMinus jet in the AntiKt4TopoEMJets collection with pt>20GeV and E>0
    - should be done AFTER all other object definitions (e.g. overlap removal)
  - IMPORTANT: keep in mind that AntiKt 0.4 TopoCluster jets with: EM+JES (TOP2012 results)/LCTopo (any analysis after TOP2012) calibration
    - at the moment still EM+JES in code
  - If electron is reconstructed inside a real jet, the energy is double counted.
    - One solution is to remove electron clusters (or cells) and re-do jet reconstruction. This is a longer term task.
    - Note that "simple" solutions, such as vetoing such mis-reconstructed events, creates new problems and does not seem to be an improvement.
    - The current recommendation is to **do nothing about the energy double counting**. This is fine as long as the effect is reproduced by the simulation.
  - JES: Final in-situ re-calibration for 2012 not yet available
  - JER (for systematic only): possibly same as 2011
  - JVF SF: for 2012 data not yet available

This needs updating/doublechecking!!

### TOPMETVector



- Updates made compared to Bill's version
  - Rather complicated tool
  - Current tag for TopMetTool is TopMetTool-00-01-00 (tested with MissingETUtility-00-02-18)
    - changed 3 lines in default composition, including RefGamma objects
    - need to double check jet scaling
  - Need to update this once we do systematic uncertainties studies!!
    - 3 main types of uncertainties that enter into the calculation of the missing ET:
      - Uncertainties associated with reconstructed objects → must be propagated to the missing ET
      - impact of pile-up → Pile-up re-weighting tool
      - impact of hardware failures  $\rightarrow$  no recommendations available yet

### Event selection



#### Changes made here

- Updated to data12 GRL, added new GRL xml in svn
- Be aware that trigger cut has been taken out!!
- Changed cutflow more or less back to how it used to be in HSG6
  - this included the cut values again (referring in particular to MET cut 30GeV vs 65GeV discussion last week)
- Need to study the cutflow but move on quickly from there to work on systematics and background estimation and finally cross-section measurement!

# Code currently in trunk is compiling but haven't tested on MC12/data D3PD yet!!

I would like to ask everyone who is working on the 2012 analysis to critically check the code asl well as keeping an eye on WG recommendations regarding object selections, scale factors, etc!!!

Latest changes in TauPlusJets2012 trunk (tagged as TauPlusJets2012-00-00-10)

# Twiki pages



- Top RootCore package versions for 8TeV analyses:
  - <u>https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/TopRootCoreRelease</u>
- Systematic uncertainties:
  - <u>https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/TopSystematicUncertainties</u>
- Top Common Scales
  - <u>https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/TopCommonScales</u>
- Top Common Objects:
  - <u>https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/TopCommonObjects</u>
- 2012 GRL
  - <u>https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/TopGRLs</u>